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PROCEEDING

International Conference and Exhibition on Sciences and Technology (ICEST) 2018

"Navigating of Recent Development on Sciences and Technology "

Labuan Bajo - East Nusa Tenggara Indonesia - 25th to 27th October, 2018

ICEST 2018

International Conference and Exhibition on Sciences and Technology

Hosted by
Faculty of Science and Engineering
Nusa Cendana University

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PROCEEDING

THE FIRST INTERNATIONAL CONFERENCE AND EXHIBITION ON SCIENCES AND TECHNOLOGY (ICEST) 2018

Navigating of Recent Development on Sciences and Technology

Reviewer & Editor :
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Andreas Christian Louk, S.Si., M.Sc
Redi Kristian Pingak, S.Si, M.Sc

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PROCEEDING THE FIRST INTERNATIONAL CONFERENCE AND EXHIBITION ON SCIENCES AND TECHNOLOGY ICEST 2018

Reviewer and Editor: Amin Ajaib Maggang, ST., MTN.Eng
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PREFACE

First of all, let us give thanks to the Almighty God, because of His abundance of grace and love, Faculty of Science and Engineering Universitas Nusa Cendana (FST-UNDANA) Kupang, Indonesia can hold an International Conference and Exhibition on Sciences and Technology (ICEST) on October 25 to 27th 2018 at the The Jayakarta Hotel, and complete the Program and Abstracts book.

This International Conference and Exhibition on Sciences and Technology (ICEST) aims to encourage the researchers, scientists, scholars, academician, graduate students, industrial practitioners, and many others of related stakeholders of people in this world to participate in disseminating and sharing findings among the experts and society through the conference entitled "Navigating of Recent Developments in Sciences and Technology" in accordance with the program areas.

The papers were distributed in ten fields of study, they are Physics, Biology, Chemistry, Mathematics, Computer Science, Electrical Engineering, Mechanical Engineering, Civil Engineering, Minning Engineering, and Architecture.

The conference was well organized because of any assistance from various parties and hard work of the Conference Committee of the Faculty of Science and Engineering UNDANA. The tasks carried out by the Committee during seminar preparation were selecting abstracts, looking for sponsors, fund-Raising, arranging, and organizing the conference.

Finally, we would like to thank the Rector of Undana, Dean of FST, Conference Committee, speakers, conference participants, sponsors and donors, students of the Faculty of Science and Engineering UNDANA and all parties who have assisted and organized this International conference. Hopefully, this Abstract book can contribute significantly to the development in the field of Science and Engineering today and in the future.

Kupang, October 20th 2018

Conference Committee

WELCOME SPEECH
Head of ICEST Committee (2018)

Great, Intelligent Delegates,

Ladies and gentlemen, Scholars and Doctors, Keynote speakers, Invited Speakers, Sponsors, Academics and Business presenters, and all of you, welcome to ICEST conference; the first International Conference conducted by the Faculty of Sciences and Engineering, Universitas Nusa Cendana, Kupang; welcome to this city, Labuan Bajo, the one of the Tourism Cities of this Country. This is one of our reasons why Labuan Bajo was chosen as the venue of the ICEST Conference.

A. BACKGROUND

On behalf to unify our perceptions and make a clearance of related information thereafter, directly or indirectly linked with the ICEST event, it is required to introduce the background and subjects required to include in the event and therefore why this ICEST Conference required. The ICEST itself is abbreviated of "International Conference and Exhibition on Sciences and Technology". For this first ICEST we have a theme as "Navigating of recent developments in sciences and technology.

Basically, science developed, is because of intellectual work reaches its momentum to improving the prosperity of the human beings. As scientists, we have senses to capture and understand the phenomena around earth and the natural facts facing all of human being which are essential resources to develop the intellectual work and navigate the developments of sciences and technologies. Hence, the current developed technologies-based natural sciences involving mathematics and engineering have already improved and facilitated the livings of human being throughout the world. Those already developed and their innovative related technologies have slightly made equally prosperity of people on this planet, a sharing prosperity arranged in acceptable regulations, of course.

We recognize and aware that matter and energy are sources of wealth that God (the Creator) provides freely to facilitate our life on this world. The material of natural wealth, both located within and originating from the earth or located and derived from the external earth can be used to facilitate easily the life. All of those wealthes, almost, can only be reached by the achievements of science and technology accompanied it. Remembering and re-stating the old word of wise people in this field that "Having a science without technology is similar with of having a useless ivory tower; otherwise operating a technology without an adequate science-based process could possibly produce the false prosperity". The meaning might probably be able to express in other languages such as "テクノロジーのない科学を持つことは、無駄なアイボリーの塔を持つことと同じです。さもなければ、十分な科学的プロセスがない違う 技術を操作することで偽の繁栄を生み出す可能性があります" or "**Memiliki sains tanpa teknologi serupa dengan memiliki menara gading yang tidak berguna, sebaliknya mengoperasikan teknologi tanpa proses berbasis sains yang memadai dapat menghasilkan kemakmuran yang semu**).

The rise of science and technology to the present day has facilitated the lives of some human being on this planet. Yes, the achievements in the various fields of the science along with the accompanying technologies have ensured that material and energy are our aids to facilitate the life. How the material transformed into the energy or energy transformed into the material has been mastered in science as well as some of the accompanying technologies. The natural phenomena and facts have made a number of human children to learn how to wear those material and energy to facilitate **a temporary life on this planet**.

The development of computer science and digital-based information technology today has opened our eyes to increasingly see many things about the material and energy circuit from the aspects of chemical and physics which are assisted by the mathematical science as well as by the astronomy and mining science/engineering. Our eyes have widely opened to understand the circuit and therefore we, the humans,

have successively produced the derived material and energy in the form of various products from various applications of the technology such as performed in engineering fields of mechanical, civil, electrical, etc. in the ingredients of the spacecraft. The art is a dress which is one of aids to completely perfect the performance of science and technology.

Again, natural phenomena and facts have also made some human children to learn and to see the material and energy from the chemical and physical aspects in realizing the biomass of life science (Biological) materials. There are many material and energy secrets that have been revealed such as how to build the physical being of the biological material of this world. The developments of science and technology in the field of biological science have strengthened us regarding the meaning of the material and energy transformations, affirming us to the meaning of life on this planet. Overall, the navigating of recent developments in science and technology emergently required to continuously improving the lives of human being, our people, and society throughout the world. Therefore the International Conference and Exhibition on Sciences and Technology conducted by the Faculty of Science and Engineering Universitas Nusa Cendana Kupang encouraged the researchers, scientists, scholars, academician, graduate students, industrial practitioners, and many others of related stakeholders of people in this world to participate in disseminating and sharing findings among the experts and society through the conference entitled mentioned.

B. GOALS AND SUBJECTS

Actually, this conference has two main goals that are goals linking with the academics and those others linking with business. The goal linking with academics operationally defined in program areas, which are covered into the following subjects of each field but not limited to:

Field of physics:	**Field of Electrical Engineering:**
*Applied Geophysics	*Telecommunication and Network
*Applied Nuclear Physics	*Instrumentation and Control
*Material Physics	*Power Transmission and Distribution Systems
*Instrumental Physics	*Energy Conversion and Renewable Technologies
Field of Biology:	**Field of Civil Engineering:**
*Anatomy and Physiology	*Construction and Building Materials
*Biodiversity	*Hydraulic and Hydrology Engineering
*Bio-conservation	*Geotechnical and Foundation Engineering
*Bio-pharmacology	*Construction-Project Management
Field of Chemistry	**Field of Mechanical Engineering**
*Biochemistry/Nutritional Biochemistry	*Automotive Engineering
*Biotechnology	*Product Design and Manufacturing Engineering
*Material and Polymer Science	*Materials Science and Engineering
*Natural Product	*Energy Conversion and Renewable Energy
Field of Mathematics	**Field of Architecture**
*Algebra and Its Applications	*Sustainable Eco Green Architecture

*Applied and Computational Mathematics	*Architectural Design
*Pure Mathematics	*History Theory and Criticism of Architecture
*Mathematical Educations	*Building Science and Technology
Field of Computer Science	**Field of Mining Engineering**
*Computer Network and Security	*Geological Survey and Exploration
*Mobile Computing	*Development in Mining System and Technique
*Decision Support System	*Technology Developments in Mineral Processing
*Web and Cloud Computing	*Mining Environment Conservation & Rehabilitation

The goal linking with the business definitely involved in exhibition. The exhibition is aimed at local products from each district/city in NTT and/from other regions in Indonesia. This breakthrough is in line with the creation of sea toll lines already and/are being encouraged by the current central government. Thus, this event becomes an opportunity for promotion and creation of trade agreements between regions within the province as well as with other provinces in Indonesia. Trade agreements implementing a barter system might be better to be performed, thus contributing to the suppression of inflation values in their respective regions. Additionally, presentations that offer investment opportunities in each region can also be very promising for domestic investors to see the opportunities that existed in each region. The sea toll line created, therefore, can provide the greatest benefit for the people in this area and/others of Indonesia. Overall, the exhibitions and business presentations encouraged in this event may involve all Regional Device Work Units (known as SKPD) of Districts/Cities in NTT and/other district/city SKPDs from all over Indonesia, willing to utilize the event for the benefit of their respective regions.

Exhibitions and business presentations can also be utilized by the industry to offer the marketing of industrial products, as well as the results of technological findings that can be traded between industries. All kinds of industrial products based on the selected products conducted by the conference committee "can be presented in Labuan Bajo". In this connection, the presenter may sell the right of production on the basis of the granted patent documents, for example. Thus, this event can be useful for researchers/inventors both coming from universities and those from the industries. Instead of the domestic researchers/inventors, the event can also be utilized by researchers/inventors from Universities/Industries abroad to pioneer bilateral cooperation, for example, either G to G/B to B / or B to G.

Both those goals were considered importantly to include in this conference event because the event could **meet the people** from any regions in a province, any provinces in a country, and any countries in this planet, we meet in this tourism city of the NTT province, Labuan Bajo (Let us give applause for all of us). This event is able to perform today because of enthusiasm, high commitments, and hard works of the ICEST committee which are supported strongly by the local government, Bupati Manggarai Barat beserta jajarannya (Let us give applause for both backbones of the event).

C. OUTPUT AND OUTCOME

The output of this ICEST-2018 Conference is ICEST Proceeding in a serial form namely “ICEST-FST UNDANA PROCEEDING”. The proceeding is just only indexed in various International-based data such as Crossref and probably followed by Scilit, Google Scholar, Copernicus, etc., in advance. Creation of networks nationally and/or internationally among scientists, scholars, and participants since present to future might indicate the outcome of the event. In this connection, understanding the biological material transformations from the earth into life, in life, and it backs to the original earth might encourage people to spread their attention and affection for all people throughout the world, we are almost same, not so higher, and/or lower than that of the others.

D. FUNDINGS

The source of funds for this event was collected from various resources that are from DIPA FST/Undana, sponsors, participants, and other creativities of the ICEST committee under fund section. Our sponsors are: PT. DEKA SARI PERKASA, PT. Alfa MAS Mandiri, PT. SARANA AGRAHA GEMILANG, LPJK, ATAKI, and BANK ARTHA GRAHA INTERNASIONAL

E. WELCOME FOR GUESTS

Ladies and gentlemen, the Scholars and Doctors, Keynote speakers, Sponsors, Academics and Business Presenters, and all of you, we, the ICEST Committee, the Faculty of Sciences and Engineering, and the Nusa Cendana University Kupang, from our deep heart, we appreciate your efforts to join this conference. We are aware that this is not an easy decision to take a part in this event, to prepare time and anything, to reach 100% completed. We have speakers/presenters that could not join us here, because they could not reach 100% completion of their preparation. We appreciate also for their efforts. So, how about our keynote and invited speakers as well as all our presenters that are already presence here, join with us? They have already successively prepared their selves to join us here, from here from our deep heart; we highly appreciate (Give applause). Firstly, let us give applause for our Guest Keynote Speakers: Prof. Teruyoshi from Japan (We kindly invite Professor to stand up), Prof. Djoko Lego from UGM (We kindly invite Professor to stand up), Prof. Nana R. Syambas from ITB Bandung (We kindly invite Professor to stand up), Lady Fainmarinat Inabuy, PhD from Washington University, USA (We kindly invite Lady to stand up) and our host Keynote Speaker, Prof. Fred L. Benu (the President of Universitas Nusa Cendana, Kupang). Let us give a long applause for all of them). Secondly, let us give applause for our sponsors (We kindly invite sponsors to stand up, from the left to the right) Sponsor from PT. DEKA SARI PERKASA, PT. Alfa MAS Mandiri, PT. SARANA AGRA GEMILANG, LPJK, ATAKI, and Bank ARTHA GRAHA INTERNATIONAL, and let us give applause for our presenters.

F. CONFERENCE SCHEDULE AND FIELD TRIPS

Today, this afternoon, we establish the ICEST opening ceremony while presentation sessions will be conducted tomorrow from morning to afternoon/evening. The presentation session will be started by the Keynote speakers and followed by the parallel session, either academics or business presentations, that are oral presentations, posters, and promotion of products from any industries, Government/SKPD, UKM, etc. The committee will organize it for us. The October 27 morning, we will get field trips which are coordinated specifically by the agent.

"There is no ivory that is not cracked
If there are broken needles, do not store them in a chest
If there is a wrong word, do not store it in your heart"

Labuan Bajo, Kupang, Indonesia,
October 25, 2018
Head of ICEST Committee

Prof. Yohanes Buang, M.Agr., PhD

WELCOME SPEECH
by the Dean, Faculty of Science and Engineering

Great, Excellencies Delegates,

Ladies and Gentlemen, the Scholars and Doctors, the Keynote speakers, sponsors, the Academics and Business presenters, and all of you, welcome to ICEST conference; the first International Conference conducted by the Faculty of Sciences and Engineering; welcome to this city, Labuan Bajo.

We choose this city, Labuan Bajo, as the venue of this conference because of it has background as one of the tourism cities in this country. We would like to expose the strengths of this region. The typical archipelago, dry lands, and high intensity of sunshine radiated through this region are some unique power owned by the NTT province. By navigating of recent development in sciences and technology might, those unique power, provide the new areas of researches to promote the sciences and accompanying related technologies. The mentioned areas are directly related with field studies of 11 departments in Faculty of Science and Engineering, Universitas Nusa Cendana, Kupang.

The International Conference and Exhibition on Sciences and technology (ICEST) is one type of the applications of the university's vision by the Faculty of Science and Engineering. The committee preparing this conference aims to encourage two main goals, namely academics and business. The goal linking with academics operationally defined in academic program areas, while the goal linking with the business definitely involved in exhibition. Therefore, in this conference, we'll have academic and/or business presentation.

The exhibition is aimed at local products from each district/city in NTT and/from other regions in Indonesia. This breakthrough is in line with the creation of sea toll lines already and/are being encouraged by the current central government. Thus, this event becomes an opportunity for promotion and creation of trade agreements between regions within the province as well as with other provinces in Indonesia. Trade agreements implementing a barter system might be better to be performed, thus contributing to the suppression of inflation values in their respective regions. Additionally, presentations that offer investment opportunities in each region can also be very promising for domestic investors to see the opportunities that existed in each region. The sea toll line created, therefore, can provide the greatest benefit for the people in this area and/others of Indonesia. Overall, the exhibitions and business presentations encouraged in this event may involve all Regional Device Work Units (known as SKPD) of Districts/Cities in NTT and/other district/city SKPDs from all over Indonesia, willing to utilize the event for the benefit of their respective regions.

We would like to acknowledge our keynote speakers, invited speakers, presenters both academics and business. We sincerely hope that this activity is beneficial for all of us, especially to accelerate the development of science and technology for both, host and the respective presenters. Again welcome to Labuan Bajo, enjoy for your presentations, and enjoy the beauty of traveling in this city.

Labuan Bajo, Kupang, Indonesia,
October 25, 2018
Dean

Drs. Hery Leo Sianturi, M.Si

WELCOME SPEECH
Rector of Nusa Cendana University

Excellencies, Distinguished Delegates,

Ladies and Gentlemen,It is a great pleasure for me to welcome you all to this International Conference and Exhibition on Sciences and Technology (ICEST); the first international conference conducted by the Faculty of Science and Engineering, Nusa Cendana University, here in Labuhan Bajo, a transit city for tourists visiting Komodo National Park. It is an opportunity to all of us to make new contacts and to renew the existing ones while discussing problems of mutual interest with delegates from different parts of Indonesia and overseas.

Nusa Cendana University is a global oriented university. This vision is in line with our strategic location in the frontline of our country to two neighbouring countries, Australia and Timor Leste. It is also in line with the development of information technology today in the era of digital revolution. In our efforts to meet this vision, we strive to develop collaborations with both national and international universities, governmental and non-governmental organizations, and business world to improve our teaching, research, and community services. Yet, this vision has also guided us to look more deeply inward in our efforts to understand both the strengths and weaknesses of this region, the East Nusa Tenggara Province. Together with part of the neighbouring provinces West Nusa Tenggara and Maluku, East Nusa Tenggara is the driest province in Indonesia, receiving rainfall only for 2-3 months a year and as such qualifies as the only true drylands in Indonesia and the only archipelagic drylands in the world. We share this condition with our neighbours Australia and Timor Leste, but the drylands in Australia are continental.

The semi-arid climate archipelagic geography allows East Nusa Tenggara to enjoy a number of competitive advantages. In every island there are beautiful beaches no tourist can resist. Beaches with high waves in the southern coast of islands bordering the Indian Ocean invite surfers from various parts of the world. The archipelagic drylands have forced plants and animals in this province to evolve distinctly from those in other provinces. We have endemic plants such as white sandal (*Santalum album*) and endemic animal such as komodo dragon (*Varanus komodoensis*), thanks to this evolutionary force made possible by the challenging dryland environment. We owe the archipelagic geography (nusa) and the white sandal (cendana) for the name of our university. We should thank komodo dragon for making Labuhan Bajo one of the fastest growing tourist destination now in Indonesia. But drylands do not mean always dry. Flores island is mountainous and milder climate can be found on top of such mountains where different types of plants and animals thrive. Indeed, Kelimutu National Park with its three lakes of periodically changing colour, a popular scenic tourist destination, is located on top of a dead volcano.

The unique climate and geography of the archipelagic dryland of this province have shaped not only plants and animals but people as well. People in this province are so heterogenous that those living in one island belong to different ethnic groups and speak different languages. People of each of such ethnic groups nurture their own tradition and culture in the forms of cuisines, fabric, housing, music, and dancing. A traditional fabric known as tenun ikat is a trade mark of each ethnic group in this province that now has become a popular tourist souvenir. In nurturing their tradition and culture, people interact with their local environment under the guidance of their local knowledge and wisdom, allowing them not only to benefit from but also to take care for the available natural resources. Drylands are indeed not just about climate, geography, and soil, but about shaping and reshaping of all of their components, of people and their environment in particular.

It is this unique physical, social, and cultural environment that encourages us to develop archipelagic dryland as the scientific orientation of the university. We ask each of our 11 faculties and 47 undergraduate programme of studies to implement this scientific orientation in accordance with its field. For example, the Faculty of Agriculture should focus in developing centres of excellence in areas of dryland agriculture. On the other hand, the Faculty of Medicine, the Faculty of Veterinary Medicine, and the Faculty of Public Heath

each should focus in developing centres of excellence in areas of tropical health and zoonosis. Similarly, the Faculty of Science and Engineering should focus in developing centres of excellence in areas of science and engineering relevant to archipelagic drylands. Each faculty and programme of study should be able to implement this scientific orientation in its teaching, research, and community service activities. We also ask our graduate programme and its programme of study to do so.

This International Conference and Exhibition on Sciences and Technology (ICEST) is an event carefully planned by our Faculty of Science and Engineering to implement our vision and scientific orientation. The organizing committee have told me that this conference and exhibition aims to achieve both academic and business goals. The conference programme will provide the venue to achieve the academic goal, whereas the exhibition is the venue to achieve the business goal. Not surprisingly, throughout this conference and exhibition we will deal with both academic and business presentation.

We would like to acknowledge our keynote speakers, invited speakers, presenters, both academics and business. We sincerely hope that this activity is beneficial for all of us, especially to advance the development of science and technology for the benefit of both the host and the respective presenters. On behalf of the university, allow me to thank the organizing committe for their hard work in carefully planning and excecuting this conference and exhibition. Again welcome to Labuan Bajo, enjoy for your stay and please feel free to explore the beauty of this city. Last but not least, on behalf of the Almighty God and all of us, allow me as the Rector of Nusa Cendana University to pronounce this International Conference and Exhibition on Sciences and Technology officially open.

Kupang and Labuhan Bajo, Indonesia,
25 October 2018
Rector,

Prof. Ir. Fredrik L. Benu, M.Si., Ph.D.

COMMITTEES

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	: Drs. Agustinus C. Dula (Regent of West Manggarai District)
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	: Johanis F. M. Bowakh, ST, MT (2nd Vice Dean)
	: Suliha N. I. Neonufa, ST, MT (3rd Vice Dean)

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CONFERENCE INFORMATION

Tema : Navigating of Recent Developments in Sciences and Technology
Committee : Faculty of Science and Engineering UNDANA (FST-UNDANA)
Venue : The Jayakarta Hotel, Labuan Bajo East Nusa Tenggara, Indonesia
Secretariat : Faculty of Science and Engineering, UNDANA, Adisucipto St, Penfui, Kupang, Telp.0380-881558
Website : http://icest.undana.ac.id

Schedule

First day: October 25, 2018

Time	Activity
13.00-17.00	Registration
17.00-19.00	Opening Ceremony • Traditional Dance • Welcome speech from Organizing Committee • Speech from Regent of Manggarai Barat • Speech from Rector of University of Nusa Cendana and formally open this event • Pray • Traditional Dance
19.00-Selesai	Gala Dinner

Second day, October 26, 2018

Time	Activity	Session Chair
07.30-08.00	Registration	Organizing Committee
08.00-08.40	Presentation from 1st Keynote Speaker Prof. Fredrik L. Benu, M.Si, PhD	Philipi de Rozari, Ph.D
08.40-09.20	Presentation from 2nd keynote speaker Prof. Teruyoshi Yanagita	Prof. Yohanes Buang
09.20-10.00	Presentation from 3 keynote speaker Prof. Dr. Nana Rachmana Syambas	Dr. Denik S. Krisnayanti, ST., MT

10.00-10.30	Break	Organizing Committee
10.30-12.00	1st Parallel session	Organizing Committee
12.00-13.00	Lunch Time	Organizing Committee
13.00--13.40	Presentation for 4th keynote speaker Prof. Dr. Djoko Legono	Dr. Partogi H. Simatupang
13.40-15.30	2nd parallel session	Organizing Committee
15.30-16.00	Break	Organizing Committee
16.00-16.40	Presentation from 5th keynote speaker Prof. Alain Dufresne	Dr. Jefri Bale
16.40-17.20	Presentation from 6th keynote speaker Prof. Arlene Bertuso	Aming Magang, ST., MTNEng
17.20-18.10	Break	Organizing Committee
18.10-19.10	3rd Parallel session	Organizing Committee
19.10- Selesai	Closing Ceremony	Organizing Committee

Third day: October 27, 2018

Field Trip

SCHEDULE OF THE PARALLEL SESSION

First Parallel Session

First Room

Time	Name/Institution	Paper Titles	Moderator
10.30 – 10.40	Valmiana Paula, etc *Department of Informatics, Nusa Nipa University, Maumere*	Design the Application of Learning Historical Site for Children Based on Mobile	Meksianis Z. Ndii, S.Si., M.Math.Sc, Ph.D
10.40-10.50	Aloysius Bagas Pradipta Irianto, etc *Department of program of Information system, Universitas Atma Jaya Yogyakarta*	Automation of Accounting Systems in Non Profit Organizations Based on PSAK 45 Standards	
10.50-11.00	Hendro Gunawan, *Department of Information System, Faculty of Industrial Technology, Universitas Atma Jaya Yogyakarta*	Identifying Factors Affecting Smart City Adoption using The Unified Theory of Acceptance and Use of Technology (UTAUT)	
11.00-11.10	Hendro Gunawan, *Department of Information System, Faculty of Industrial Technology, Universitas Atma Jaya Yogyakarta*	Information Technology Services Management Analysis using The Information Technology Infrastructure Framework (ITIL) on The Service Strategy Domain	
11.10-11.20	Flourensia Sapty Rahayu, etc *Information system Department, Atma Jaya Yogyakarta University*	Chain of Custody: Pre Implementation Issues in Yogyakarta Province Private Forest	
11.20-11.30	Yohanes Priadi Wibisono *Information system Department, Atma Jaya Yogyakarta University*	Data Warehouse for School Improvement: Digital Catalog Design to Improve Relationship and Communication	
Second Room			
10.30-10.40	Laura Anastasi Seseragi Lapono, etc *Department of Physics, Faculty of Science and Engineering, University of Nusa Cendana*	Design of Noise Level Monitoring Based On Arduino Uno	Dr. Jefri S. Bale, ST, M.Eng
10.40 – 10.50	Cornelia Hildegardis, etc *Department of Architecture, Udayana University, Denpasar*	The Effect of Orientation to Thermal Comfort in Traditional House in Bena, Bajawa, Nusa Tenggara	

10.50-11.00	Ni Putu Suda Nurjani, etc *Mahendradatta University, Engineering Faculty*	Space Alteration of Traditional Balinese Housing in Bali's Southern Tourism Area	
11.00-11.10	Rapmaida M. Pangaribuan, etc *Department of Mathematics, Faculty of Sciences and Technique, University of Nusa Cendana*	Optimizing Baby's Diets During The Complementary Feeding Period Using Linear Programming In Kupang City	
11.10-11.20	Hery Leo Sianturi, etc *Department of Physics, Faculty of Science and Engineering, University of Nusa Cendana*	The Identification of Stress Coulomb Changes in Lombok Earthquakes on August 5 and 9, 2018.	
11.20-11.30	Yulius Harjoseputro, *Information system Department, Atma Jaya Yogyakarta University*	Classifying Javanese Latters with Convolutional Neural Network (CNN) Method	
Second Parallel Session			
First Room			
13.40-13.50	Silvester Tena, etc *Department of Mechanical Engineering, Faculty of Science and Engineering, Universitas of Nusa Cendana*	Face Recognition based on Discrete Wavelet Transform and Euclidean Distance	Meksianis Z. Ndii, S.Si., M.Math.Sc, Ph.D
13.50-14.00	H. Z. Kotta, etc *Department of Mining Engineering, Universitas Nusa Cendana Kupang, Indonesia*	The Implementation of Landslide Monitoring Hazard Based on Raspberry Pi 3	
14.00-14.10	Herry F. Lalus *Department of Physics, Faculty of Science and Engineering, University of Nusa Cendana*	General Solutions of Particle Motion Equation in Schwarschild Field	
14.10-14.20	K. Rantelobo, etc *Department of Electrical Engineering, Universitas Nusa Cendana, Kupang, NTT, Indonesia*	Scalable Video Coding Based on Wireless Sensor Networks for Monitoring Object	
14.20-14.30	Agustinus Ivo Bria, etc *Department of Electrical Engineering, Faculty of Science and Engineering, Nusa Cendana University*	An Automatic Watering Device for Tomato using Soil Moisture Sensor	
14.30-14.40	Amin A. Maggang, etc *Department of Electrical Engineering, Universitas Nusa Cendana, Kupang, NTT, Indonesia*	A Real-Time Digital Sasando Tuner based on Fast Fourier Transform (FFT) and Harmonic Product Spectrum (HPS) Algorithm	
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13.50-14.00	Yohanes Buang, etc *Department of Chemistry Faculty of Sciences and Engineering, Universitas Nusa Cendana*	The Elastic Modulus of Hydrophobic Polymer Nanocomposites Reinforced with Cellulose Nanoparticles *Yohanes Buang, Alain Dufresne, Mariana Perada, Hélène Galliard, and Nadia El Kissi*	
14.00-14.10	Ika Fitri Krisnasiwi *Department of Mining Engineering, University of Nusa Cendana*	Mapping And Analysis Of Alleged Sea Water Instruction Based on The Value Of DHL And TDS From Dug Wells In The Oesapa Area	
14.10-14.20	Ika Fitri Krisnasiwi *Department of Mining Engineering, University of Nusa Cendana*	Analysis on The Effect of Groundwatertable towards The Topography and Groundwater quality, Tuafanu village, district of Kualin, South Central Timor Regency, East Nusa Tenggara Province	
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14.30-14.40	Jefri S. Bale, etc *Department of Mechanical Engineering, Faculty of Science and Engineering, Universitas of*	The Damage Behaviour of Fiber Composite under Static Tensile Test: An Observation Study of Non Destructive Testing (NDT) Thermography	

CONTENT

PROCEEDING
The First International Conference and Exhibiton on Sciences and Technology (ICEST)
Faculty of Science and Engineering UNDANA
Labuan Bajo, 25-27th October 2018

Classifying Javanese Letters with Convolutional Neural Network (CNN) Method

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Abstract. One crucial issue related to computer vision is image classification which is commonly used to detect an object in an image. The image classification process done by a computer is considered complicated therefore researchers prefer to implement some methods such as the most classic one called artificial neural network. However, there are still limitations in using this method including the number of neurons used that the results used for image classification are still not optimal. Meanwhile, one of the most popular methods which is lately used to deal with the limitations of the previous method is one technique from Deep Learning using the Convolutional Neural Network (CNN) method. The research results of implementing CNN method for classifying Javanese letter show that the accuracy level for training is 90% with training time using GPU of 409.25 seconds. The level of accuracy for the Java letters classification test is quite good, which is 85%. It is considered highly potential to be developed into a system that can recognize the Javanese letters systems.

INTRODUCTION

One of the most important problems in the field of Computer Vision is image classification. Image classification is a process to detect objects from an existing image. One popular and widely used technique for image classification is the Artificial Neural Network (ANN) method that the method can change the structure that is owned to solve problems using internal information or external information. Another definition states that this technique is can learn from the previous experiences. This ANN technique has several layers called Multi Layer Perceptron, where the concept is to fully connect the neurons so that they have powerful classification capabilities. However, there are problems with using ANN method for classification that uses images as the input. It is because the classification using images as the input requires several processes to be carried out, including preprocessing, segmentation processes and feature extraction processes. The required process has many free parameters or excessive information that will cause the classification process to be less optimal.Concerning the possible problem with applying ANN method, *Convolutional Neural Network,* other technique from Deep Learning, is considered as an alternative. This method is used to reduce the free parameters generated from the process using the ANN method.

In addition, Computer Vision currently grows very rapidly because of a technique found in the Deep Learning method or commonly called the Deep Neural Network, mainly Convolutional Neural Network (CNN) (Krizhevsky et al., 2012). These methods are the methods classified into the machine intelligence category. CNN has been able to make very significant developments in image classification problems, object detection, object localization, and image segmentation. CNN method is considered very popular dealing with Computer Vision problems and it is able to be observed at competitions such as competition of ImageNet Large Scale Visual Recognition Challenge (ILSVRC) (Russakovsky et al., 2015). This annual competition has a role in advancing Computer Vision researches. Year after year, state of the art methods emerge to win this competition, for example AlexNet (Krizhevsky et al., 2012), Google Net (Szegedy et al., 2015), and ResNet (He et al., 2015). In image classification, AlexNet outperform the rival's traditional method in the competition by its improvement more than 10% in the accuracy. At ILSVRC competition

which includes 1000 image categories, the baseline method can only get an accuracy of 0.1%. What AlexNet achieved has made CNN as de facto state of the art method which is always chosen dealing with the problems at Computer Vision

Despite the previous advantages that CNN has, it has some drawbacks as the other methods of Deep Learning have. The training done and developed for this method is very expensive in the matter of time and computing load. Even Graphic Processing Unit (GPU), which is able to accelerate parallel processes to conduct training on modern CNN's large-scale datasets such as ImageNet, remains expensive. As an example, it takes 2- 3 weeks to train VGGNet with 19 layers of the ImageNet dataset in a system with 4 GPU (Simonyan et al., 2014). CNN's high computational cost therefore caused the classical method such as artificial neural network has still more attraction since this method is considered much relatively faster than Deep Learning method.

This study therefore concerns to develop an application that is able to classify the image of Javanese letters using *Convolutional Neural Network (CNN).* This method is expected to give much better performance compared to nowadays' popular method which is Artificial Neural Network (ANN) method.

LITERATURE REVIEW

Computer vision is being one field of computer science which has been rapidly developing. It is proven by the existence of several annual competitions such as Computer Vision including Large Scale Visual Recognition Challenge (ILSVRC) (Russakovsky et al., 2015), PASCAL Visual Object Classes (VOC) (Everingham et al., 2010), and Microsoft Common Objects in Context (MSCOCO) (Lin et al., 2014). Some state of the art methods in the fields of image classification, object detection, and image segmentation are emerging through those competitions. In recent years, the Deep Learning method has succeeded in increasing performance in these competitions, far above the previous state of the art method. The initial success of Deep Learning is started by AlexNet, the image classification method based on Convolutional Neural Network (CNN), which won the first place at ILSVRC 2012 with an error rate of 15.3% while the second place got 26.2% (Krizhevsky et al., 2012).

The implementation of Deep Learning techniques with the Convolutional Neural Network method was first successfully applied by Yann LeCun in 1998 (LeCun, Bottou, Bengio, & Haffner, 1998). In this study, Yann LeCun proposed the CNN method to recognize handwriting for the purpose of reading documents. The results obtained from the study show that the accuracy is high enough to achieve a test error merely on 1.7%.

The application of the Convolutional Neural Network method can be developed in its architecture side and the number of layers used on the network. The appropriate architecture implementation affects the better image classification in various categories. An example is ImageNet dataset which has 1000 categories. In 2012, Deep Learning techniques using CNN method were popularized by AlexNet architecture tested with the ImageNet dataset (Krizhevsky et al., 2012). The architecture created by Alex Krizhevsky shows very significant results in testing sets with a test error of 17%. These results are considered very extraordinary because the images in the used dataset are very complex and lot.

In addition, Simonyan et al., (2014) conducted a similar study using 16-19 convolution layers. The finding of the study shows remarkable performance with greater accuracy than the previously developed architecture. This proves that the depth of the network is an equally important component to support good performance in image recognition. The more complex architecture in a network, the more layers will be used. AlexNet model improvement was also done by Fergus & Zeiler (2014) by changing the hyper parameter architecture, mainly by expanding the size of the convolution layer in the middle of the model arrangement and making the filter size smaller in the first layer. Based on the results, the study produced a fine model for many other datasets when Softmax classification was retrained with new data. This is very convincing considering the results given outweigh the results of previous research conducted for the Caltech-101 and Caltech-256 datasets. Szegedy et al. (2015) gives an attempt to carry out the development of the AlexNet model. The contribution of the study is the reduction of the parameters number in the network, which is only around 4 million parameters, far better than its predecessor, AlexNet, with 60 million parameters. This research also produced new breakthrough using the GoogLeNet model. The use of the proper parameters between layers in the CNN model can certainly reduce the computational load during training.

In this research, the used CNN model does not require many layers to save learning time. The uncomplicated CNN architecture used is adequate for the case of image classification with a small dataset and furthermore, the classification is simple. The less data that is obtained gives impacts on the undesirable accuracy. There have to be some steps to be

done in order to obtain better result. This technique is very easy to be implemented on the CNN model and it will have an impact on the model's performance in training and reducing overfitting (Srivastava, et.al., 2014).

The test results in this study will also be compared based on the number of epochs that are used. Then, the optimal number of epochs will be taken in terms of the model's speed and accuracy of the model in learning the data of Javanese script.

THEORITICAL FRAMEWORK

1. Deep Learning Method

Machine Learning is a method used to learn data that it can do useful things in new data that has never been recorded previously. It is different with the usual programming which is required to explicitly provide rules to the computer to execute an action. Machine Learning learns the rules implicitly and automatically from the existing data. In the past 10 years, new techniques have emerged in the field of Machine Learning which allows the system to automatically learn the data representation from raw data. The new technique in the field of Machine Learning is called Deep Learning.

Deep Learning is one of the fields of Machine Learning that utilizes artificial neural networks to implement problems with large datasets. Deep Learning techniques provide a very strong architecture for Supervised Learning. By adding more layers, the learning model can better represent the labeled data image. For example, the input layer is covered by the raw data, such as color pixels in the image. The first layer is covered by the data represented as the simplest parts of the image, for example lines. The second layer is covered by a simpler form such as the composition of the line. The next layer is filled in with more abstract and complex representation. This makes the very complex functions can be learned from the data.

2. Convolutional Neural Network Method

Convolutional Neural Network (CNN) is a part of Feed Forward Neural Network class which resembles visual cortex from the brain and it is adopted to processing data that has a grid structure. CNN has several types of layers that can be used, namely subsampling layer, convolutional layer, loss layer and fully connected layer. Subsampling layers are usually used to reduce dimensions derived from input. The goal is to reduce the number of parameters needed in CNN and also to make CNN invariant to small changes in an image. The convolution layer works by mimicking the properties of the brain's visual cortex and studying filters from the image input. This layer is called convolutional layer for the operation performed is convolution between filters and input images. The filters learned at this layer can take the form of various types, for example if they are used to learn images, they might learn to do edge detection.

The loss layer is the output layer of CNN. In image classification, if there are two classification classes, the loss layer used is sigmoid loss, where the output of the layer follows the Bernoulli distribution. In the classification of images with many classes, a Categorical distribution is used, commonly called the softmax layer. On other issues, you can use the appropriate loss layer. Dealing with regression problems, L2-loss layer can be used to calculate the difference between input and output according to the L2-norm function.

Fully connected layer is a layer commonly found on ordinary Neural Networks. Unlike the convolutional layer, the fully connected layer does not use convolution operations to get the output from that layer but it uses matrix multiplication. With the use of these operations, each input node will be connected to the hidden node in the layer therefore this layer is called the fully connected layer.

RESEARCH METHOD

1. Research Material

The dataset of this study consists of images training data, testing data, and the images of temple as the data classification.

a. Dataset of Javanese Script

This dataset contains images of all the Javanese scripts consisting of 20 categories of Javanese characters including HA, NA, CA, RA, KA, DA, TA, SA, WA, LA, PA, DHA, JA, YES, HIS, MA, GA, BA, THA, NGA. Each of them is 32 X 32 pixels. This dataset has 1000 training images and 100 test images collected

through the repository on the website. The following are the images of the Javanese script dataset for each category. There are 5 categories as follow:

- Category 1 (HA)
  In Figure 1, there are 50 training images and 5 testing images in the letters HA.

Figure 1. The Samples of HA Letters
Source: Google.com

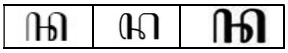


Figure 2. The Samples of NA Letters
Source: Google.com

- Category 2 (NA)
  In Figure 2, there are 50 training images and 5 testing images in the letters NA.

- Category 3 (CA)
  In Figure 5, there are 50 training images and 5 testing images in the letters CA.

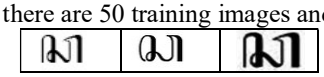


Figure 3. The Samples of CA Letters
Source: Google.com

Figure 4. The Samples of CA Letters
Source: Google.com

- Category 4 (RA)
  In Figure 4, there are 50 training images and 5 testing images in the letters RA.

- Category 5 (KA)
  In Figure 5, there are 50 training images and 5 testing images in the letters KA.

Figure 5. The Samples of CA Letters
Source: Google.com

2. Research Procedure

This research was conducted based on studying the literature review and software development with a comparison of secondary data as validation. In general, there are two main steps to be done. They are training and testing which are explained as follow:

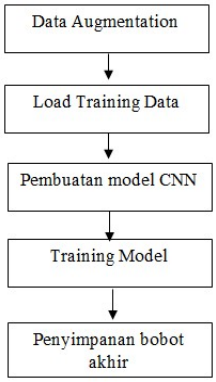


Figure 6. Research Procedure Flow Chart

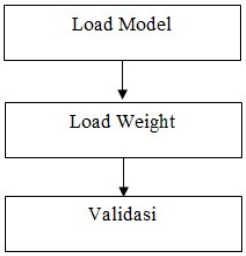


Figure 7. Testing Procedure Flow Chart

Figure 6 is the stages of training which uses bird as the object. There are 5 stages started by the augmentation data, where the image data in the dataset will be processed by giving a generator for several values that are useful to increase

the amount of data to be trained. As example, the image in the dataset can be rotated horizontally or vertically. This method can reduce overfitting. It is a condition in which training lacks data which causes too complex model. The second stage is called load training data. At this stage, it is used for reading and separating data from the dataset into 2 main parts. The first is X_Train which is used as a feature input and the second is Y Train to be used as a training label or feature output. The next stage is to make a CNN model. This stage creates the layout of the model layer to be used, the number of layers and the type of layers. The created layers will be used for the training and testing process. The last stage is the training model stage. It is a training process of inputting the image data that has been previously augmented with the network mode structured in the earlier stage. This training process will be carried out according to the specified epoch and batch size. This training process is done to produce training loads. The nest stage is to save the generated load to be validated afterward.

Figure 7 is the flow chart of the testing steps. There are 3 main stages namely load model, load weight, and validation. The load model is at the first stage which becomes the stage for CNN load model formed before. It works as the basis for the validation. The second stage is load weight. At this stage, the stored load will be reused as the main parameter for CNN model. The last stage for this process is validation process. The structure model with the stored load which is made out of the training data will be compared and tested at this stage. In this case, the accuracy between the exact results given from the test label and the results given from the network model will be compared.

RESEARCH FINDING

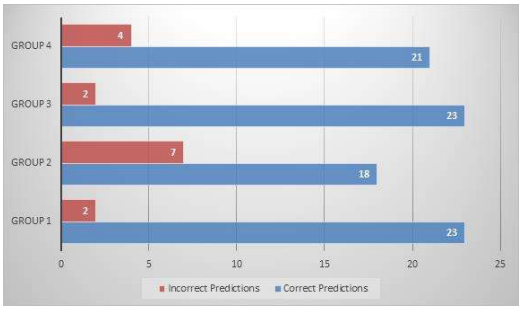
1. Research's Analysis Finding of All Groups

This study implements the dataset which contains images of all Javanese characters. There are 20 categories of Javanese characters, including HA, NA, CA, RA, KA, DA, TA, SA, WA, LA, PA, DHA, JA, YES, HIS, MA, GA, BA, THA, NGA. Each is 32 X 32 pixels. There are 1000 training images and 100 testing images. Testing results that have been carried out using 100 testing images are presented in table 1 below:

Table 1. Research Finding

No	Images	Prediction	Result
1	ba1.jpg	ba	ba
2	ba2.jpg	ba	ba
3	ba3.jpg	ba	ba
4	ba4.jpg	ba	ba
5	ba5.jpg	ba	ba
6	ca1.jpg	ca	ca
7	ca2.jpg	ca	ca
8	ca3.jpg	ca	ca
9	ca4.jpg	ca	ca
10	ca5.jpg	ca	ca
11	da1.jpg	na*	da
12	da2.jpg	na*	da
13	da3.jpg	da	da
14	da4.jpg	na*	da
15	da5.jpg	na*	da
16	dha1.jpg	dha	dha
17	dha2.jpg	dha	dha
18	dha3.jpg	dha	dha
19	dha4.jpg	dha	dha
20	dha5.jpg	dha	dha
21	ga1.jpg	ga	ga
22	ga2.jpg	pa*	ga
23	ga3.jpg	ga	ga
24	ga4.jpg	ga	ga
25	ga5.jpg	pa*	ga
26	ha1.jpg	ha	ha
27	ha2.jpg	ha	ha
28	ha3.jpg	ha	ha
29	ha4.jpg	ha	ha
30	ha5.jpg	ha	ha
31	ja1.jpg	pa*	ja
32	ja2.jpg	ja	ja
33	ja3.jpg	ja	ja
34	ja4.jpg	ja	ja
35	ja5.jpg	ja	ja
36	ka1.jpg	ka	ka
37	ka2.jpg	nga*	ka
38	ka3.jpg	ka	ka
39	ka4.jpg	ka	ka
40	ka5.jpg	nga*	ka
41	la1.jpg	la	la
42	la2.jpg	la	la
43	la3.jpg	la	la
44	la4.jpg	la	la
45	la5.jpg	la	la
46	ma1.jpg	ma	ma
47	ma2.jpg	ma	ma
48	ma3.jpg	ma	ma
49	ma4.jpg	ma	ma
50	ma5.jpg	ma	ma
51	na1.jpg	na	na
52	na2.jpg	na	na
53	na3.jpg	na	na
54	na4.jpg	na	na
55	na5.jpg	na	na
56	nga1.jpg	nga	nga
57	nga2.jpg	nga	nga
58	nga3.jpg	nga	nga
59	nga4.jpg	ma*	nga
60	nga5.jpg	ma*	nga
61	nya1.jpg	nya	nya
62	nya2.jpg	nya	nya
63	nya3.jpg	nya	nya
64	nya4.jpg	nya	nya
65	nya5.jpg	nya	nya
66	pa1.jpg	pa	pa
67	pa2.jpg	sa*	pa
68	pa3.jpg	pa	pa
69	pa4.jpg	pa	pa
70	pa5.jpg	pa	pa
71	ra1.jpg	ra	ra
72	ra2.jpg	ra	ra
73	ra3.jpg	ra	ra
74	ra4.jpg	ra	ra
75	ra5.jpg	ra	ra
76	sa1.jpg	na*	sa
77	sa2.jpg	dha*	sa
78	sa3.jpg	sa	sa
79	sa4.jpg	ka*	sa
80	sa5.jpg	sa	sa
81	ta1.jpg	ta	ta
82	ta2.jpg	ta	ta
83	ta3.jpg	ta	ta
84	ta4.jpg	ta	ta
85	ta5.jpg	ta	ta
86	tha1.jpg	tha	tha
87	tha2.jpg	tha	tha
88	tha3.jpg	tha	tha
89	tha4.jpg	tha	tha
90	tha5.jpg	tha	tha
91	wa1.jpg	wa	wa
92	wa2.jpg	wa	wa
93	wa3.jpg	wa	wa
94	wa4.jpg	wa	wa
95	wa5.jpg	wa	wa
96	ya1.jpg	ya	ya
97	ya2.jpg	ya	ya
98	ya3.jpg	ya	ya
99	ya4.jpg	ya	ya
100	ya5.jpg	ya	ya

The tests carried out in Table 1 above were done using the image testing for 100 times. Each category has 5 testing images. The table is divided to columns of images, prediction and the results generated after using the CNN method. The 100 times testing show the accuracy of correct prediction on 85% with 15 times prediction error or 15% of performed testing for 100 times.



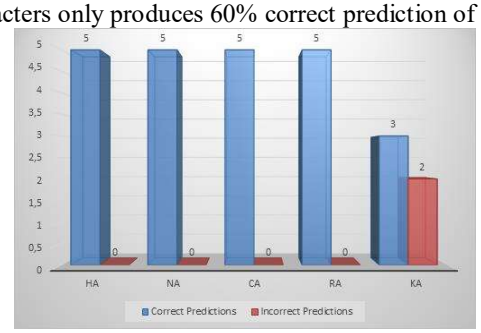
Graph 1. Graph of Prediction for All Groups

Graph 1 shows the prediction results for all groups. Group 1 is HA, NA, CA, RA, KA. Group 2 is DA, TA, SA, WA, LA. Group 3 is PA, DHA, JA, YA, NYA and group 4 is MA, GA, BA, THA, NGA. The graphs shows that group 1 and group 3 are showing the highest accuracy of prediction on 92% while the lowest accuracy percentage is shown by group 2 on 72%. Category 4 shows 84% on the prediction accuracy.

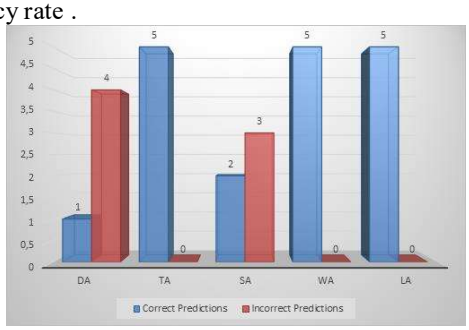
2. Research's Analysis Finding of All Groups

a. Group 1 (HA, NA, CA, RA, KA)

Graph 2 shows the test results for group 1 namely HA, NA, CA, RA, KA by using 25 times test in total with adopting1000 training images. HA, NA, CA, RA characters produce 100% of accuracy, while railway characters only produces 60% correct prediction of accuracy rate .



Graph 2. Graph of Testing Finding for Group 1 (HA, NA, CA, RA, KA)



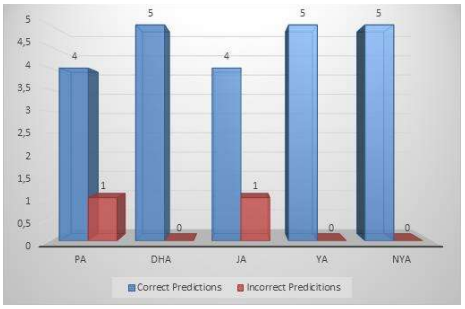
Graph 3. Graph of Testing Finding for Group 2 (DA, TA, SA, WA, LA)

b. Group 2 (DA, TA, SA, WA, LA)

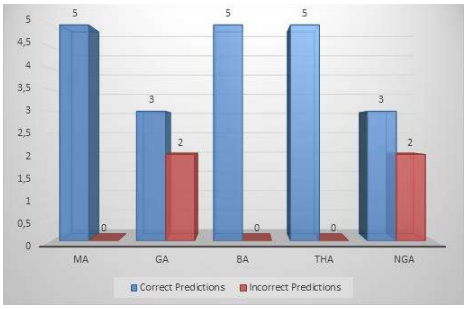
Graph 3 is a graph of the test results for group 2, namely DA, TA, SA, WA, LA using 25 times testing in total and using 1000 training images. TA, WA, and LA characters got 100% of accuracy rate while DA characters only produces 20% of correct prediction accuracy. SA character only produces 40% of accuracy prediction rate. DA character encounter missed prediction at 80% that it gave result to NA letters. SA character got 60% of missed prediction letters. The findings are NA, DHA, and KA.

c. Group 3 (PA, DHA, JA, YA, NYA)

Graph 4 is the graph of the test findings for group 3, namely PA, DHA, JA, YA, NYA by using 25 times test in total with adopting1000 training images. DHA, YA, and NYA letters are proven 100% accurate while PA and JA characters are 80% accurate. PA letters had false prediction results at 20% for it predicted SA letters. JA character showed missed prediction of 20% for the result shows PA character.



Graph 4. Graph of Testing Finding for Group 3 (PA, DHA, JA, YA, NYA)



Graph 5. Graph of Testing Finding for Group 4 (MA, GA, BA, THA, NGA)

d. Group 4 (MA, GA, BA, THA, NGA)

Graph 5 shows the test findings for group 4, namely A, GA, BA, THA, NGA by using 25 times test in total with adopting1000 training images. MA, BA, and THA letters are proven 100% accurate while GA and NGA characters are 60% accurate. GA letters had false prediction results at 40% for it predicted PA letters. NGA character showed missed prediction of 40% for the finding shows MA character.

CONCLUSION

The finding of the study gives a conclusion that Javanese letters classification using Convolutional Neural Network (CNN) method shows the accuracy level at 85% with adopting 1000 training images and 100 testing images. Concerning each degree of accuracy on every group, it is found that group 1 and group 3 have been 92% accurate while group 2 is the least accurate since group 2 has been 72% accurate. At the letters level, HA, NA, CA, RA, TA, WA, LA, DHA, YA, NYA, MA, BA, and THA have been 100% accurate. However, DA letters is the least on the accuracy for it got the highest level of missed accuracy. It failed to give the exact prediction for four times.

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